91. (new) The method of claim 90 wherein the method for forming each of at least ten of the materials further comprises annealing the lattice or superlattice for low-temperature diffusion between component layers.

92. (new) The method of claim 90 wherein the method for forming each of at least ten of the materials further comprises annealing at a temperature of less than about 800 °C.

93. (new) The method of claim 90 wherein the method for forming each of at least ten of the materials further comprises annealing at a temperature ranging from about 200 °C to about 300 ° C.

94. (new) The method of claim 92 wherein the method for forming each of at least ten of the materials further comprises sintering at a temperature of about 800 °C or more.

95. (new) The method of claim 90 wherein each of the first, second and third layers are thin films having a thickness ranging from about 100 Å to about 1000 Å.

REMARKS

Claims 8, 10, 11, 15-24, 26, 30-35, 42, 43, 45-49, 51-56, 58-60, 64-72, 74-80 are now pending in the above-referenced patent application. Of these, claims 58, 59 and 79 are drawn to non-elected species, and have not been considered on the merits. Applicants respectfully request further consideration of these claims, in view of the amendments set forth above and the following remarks.

Examiner Interview

Applicants thank the Examiner for the courtesy of an interview on May 10, 2001, during which the claims, the specification, and the Cavichhi *et al.* reference were discussed.

Amended Claims

A marked-up version of the amended claims showing the changes thereto is attached as Appendix A.

Claims 42, 68, 70, 72 and 74 have been amended to clarify that the first (and second) component is delivered to form a solid layer comprising the delivered first (and second) component. Support for this amendment can be found throughout the specification, including for example at page 28, line 6 through page 34, line 25, and especially, at page 28, lines 25-30 and at page 29, lines 9-10. Claims 42, 68, 70, 72 and 74 have also been amended to clarify, without change in the substantive scope thereof, that the composition, concentration, stoichiometry or thickness of the delivered first or second components are varied between regions. Support for this amendment can be found throughout the specification, including for example at 18, lines 14-32, and the various Examples.

No new matter has been added.

New Claims

New claims 81-95 have been added to claim particular embodiments of the invention. Support for these claims can be found throughout the specification, including for example, as follows. Claims 81, 82 and 83 correspond to previously-filed claims 20, 55 and 67, respectively, but depend from claims 68 or 69 (rather than claims 42 or 43). Claim 84 requires that the composition, concentration, stoichiometry or thickness be varied as a gradient when comparing such parameters between respective regions. (*See*, for example: page 18, lines 22-24; page 20, lines 5-8; page 21, lines 29-32; page 28, lines 17-20; page 34, lines 26-33; page 59, lines 20-29; page 64, lines 16-26 and the various Examples). Claim 88 requires that the delivery of the first and second components (with variation in at least one of the components as compared between regions) is repeated at least once to form a lattice or a superlattice. (*See*, for example: page 18, lines 15-26; page 29, lines 21-23; and the various Examples). Claims 85 and 89 correspond substantially to claim 69. Claims 86, 87 and 90 each require a third component. (*See* page 32, line 15 through page 34, line 25, as well as page 35, line 3 through

page 37, line 9). Claims 91-94 require various annealing and/or sintering treatments. (*See*, for example, page 50, lines 4-23 and the various Examples, including Examples C and D). Claim 95 requires that the layers are thin films with a thickness ranging from about 100 Å to about 1000Å. (*See*, for example, page 34, lines 31-33, and the various Examples).

No new matter has been added.

Acknowledgement

Applicants acknowledge that the Office action does not maintain, and has withdrawn many of the rejections set forth in the previous Office action dated March 17, 2000, including specifically: (i) the objection to the specification under 37 CFR 1.72 as lacking an abstract; (ii) the objections to claims 30-36 due to informalities; (iii) the rejections under 35 U.S.C. § 112, 2nd paragraph, except with respect to "property of interest" as recited in claims 43, 69, 71, 74 and claims dependent therefrom; (iv) the rejection of claim 48 under 35 U.S.C. § 112, 1st paragraph as to written description; (v) the rejections under 35 U.S.C. §102 and § 103 over the Chern reference, and independently, over the Rolleston reference; and (vi) the rejections under 35 U.S.C. § 103 over Cavicchi *et al.* (*See* paragraph 4 at page 3, and paragraph 15 at page 12 of the Office action). Accordingly, there are no art-based rejections for claims 20-22, 55, 56, 67, 72, 75 or 76.

Rejections Under 35 U.S.C. § 112, 2nd Paragraph

Certain of the pending claims have been rejected under 35 USC §112, 2nd paragraph as being indefinite. Each of these rejections are traversed in view of the following remarks.

Screening Materials for a Useful Property of Interest

The Office action maintains that claims 43, 69, 71 and 74, together with certain claims depending therefrom (*i.e.*, claims 15-22, 30-35, 45-49, 51-56, 60, 64-67, 69, 71, 75-78, and

80)[1] are indefinite in that these claims "fail to set forth what a property of interest is." (*See* paragraph 11 at page 8 of the Office action). In particular, the Office action maintains that a person of ordinary skill would not be reasonably appraised of the scope of the invention, because "it is still unclear as to what this property is and how it relates to the particular material of the array." (*See* paragraph 12 at pages 8-9 of the Office action).

Claims 43, 69, 71 and 74 are each directed to methods for identifying useful materials. The methods defined by these claims comprise making particularly-characterized arrays of different materials, screening the materials for a useful property of interest, and determining the relative performance of the materials with respect to the property of interest.

A person of ordinary skill in the art can readily delineate whether or not they are screening materials for a useful property – that is, for a particular quality, trait or function that is useful in (or that imbues the material with utility in) a particular application. In particular, Applicants note that a researcher employing Applicants' invention for materials research would not be conducting such research in a vacuum. Rather, a skilled artisan would be employing Applicant's invention to identify a useful material for one or more particular applications (*e.g*, end-uses for the material). Based on the desired application, one or more material properties of interest would be apparent to a person of ordinary skill in the art.

Applicants' invention relates to a general protocol for preparing arrays of materials in a format that is useful for screening. The format is not limited to particular applications, and is not limited to particular types of specific materials in connection with such applications. As such, it would unduly limiting to require Applicant to recite particular properties of interest. Moreover, the specification provides substantial guidance with respect to delineating properties of interest that are common among varied end-use applications.[2] Regardless of the particular

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1 Applicants note that claims 66, 75 and 76 neither recite the "property of interest" language or depend from a claim that recites such language. As such, the instant rejection appears to be moot with respect to these claims. Clarification is respectfully requested.

2 For example, properties can be broadly classified as including electrical, thermal, mechanical, morphological, optical, magnetic and/or chemical properties. *See*, for example, page 53, lines 27-28. An extensive, more specific, non-limiting list of "useful properties" is also set forth. *See*, for example, Table 1 on pages 54 and 55 of the specification.

application of interest, a person of ordinary skill in the art would certainly be able to know and determine whether such an array had been screened for a material property. Hence, the requirement to screen the materials for one or more useful properties of interest has a definite and well-understood meaning, and adequately defines the metes and bounds of the invention. *See* In re Gardner, 166 USPQ 138, 140 (CCPA 1970).

Array Consisting Essentially of the Substrate and the Ten or More Different Materials

Additionally, the Office action newly rejects claim 80 as being indefinite with respect to the recited transition, "consisting essentially of". The Office action states that "it is unclear what 'consisting essentially of' would mean in the context of (A)pplicants' invention," and specifically, "it is unclear what would and would not materially affect the basic and novel characteristics of the claimed invention." (*See* paragraph 26 at page 16 of the Office action).

Claim 80 requires that the array of materials consists essentially of the substrate and ten or more different materials – thereby excluding substrates comprising active devices such as micro-hotplates as taught by Cavicchi *et al.* A skilled artisan would appreciate that the essential absence of such active devices defines (for claim 80) the basic and novel characteristics of the invention. As such, the transitional phrase is not indefinite in the instant context – it would allow for an array comprising other features (*e.g.*, material impurities, structural features (*e.g.*, such as alignment apertures for mounting in a screening device), *etc.*), while excluding *in-situ* active devices. Accordingly, the recited transition adequately defines the invention.

Rejections Under 35 U.S.C. § 112, 1st Paragraph (Enablement)

Each of the previously-pending claims have been rejected under 35 USC §112, 1st paragraph, as lacking enablement. Specifically, the Office action maintains that the specification would not have enabled a skilled artisan to make and use the invention commensurate with the scope of the claims. (*See* paragraph 6 of the Office action).

Applicants respectfully traverse this basis for rejection in view of the amendments to the claims and the following remarks.

The rejected independent claims require forming arrays comprising ten or more different inorganic materials (claims 42, 68, 70, 72 and 74) or non-biological polymeric materials (claim 74) by delivering two or more (claims 42, 68, 72 and 74) or five or more (claim 70) components thereof in sequential layers. Certain claims (*e.g.*, claims 43, 69, 71, 72 and 74) are directed to using such arrays to identify useful materials.

Significantly, a person of ordinary skill in the art would have recognized that Applicants' invention represents new formats, approaches and protocols for investigating (*e.g.*, discovering and/or optimizing) materials – generally, and without regard to particular chemistries – and as such, that the invention can readily be applied with existing, *known* chemistries. Accordingly, the uncertainties associated with chemistry and materials science (*e.g.*, as noted in the Office action) are of little, if any, relevance with respect to Applicants invention.

Applicants submit that a skilled artisan would have been fully enabled to make arrays as claimed, and to evaluate such arrays for a property of interest, in view of the substantial guidance set forth in the specification, taken together with knowledge in the art at the time the application was filed.

The specification provides substantial guidance for making and screening arrays comprising diverse inorganic or non-biological polymeric materials according to the methods defined in claims 42, 68, 70, 72, 74 and claims dependent therefrom. In particular, an overview of general and specific approaches is provided (*See* page 17, line 7 through page 23, line 3 of the specification), together with specific details regarding various component-delivery approaches. Thin-film deposition methods such as evaporative methods, glow-discharge processes, gas-phase chemical processes, liquid-phase chemical processes and multi-target thin-film deposition techniques are disclosed in significant detail, and are particularly suited to delivery of inorganic components. (*See*, for example, page 28, line 6 through page 37, line 13 of the specification, as well as page 40, line 23 through page 49, line 17 of the specification). Delivery with a dispenser is also described in significant detail, and is suitable for delivery of inorganic or non-biological polymeric components (*See*, for example, page 37, line 13 through page 40, line 22 of the specification, as well as page 46, line 10 through page 49, line 17 of the

specification). The specification also describes various approaches for isolation of predefined regions (*See*, for example, page 23, line 24 through page 27, line 29 of the specification). Each of the disclosed approaches is particularly suitable for use in connection with inorganic elements or compounds as components for making arrays of diverse inorganic materials. Some of such literature is specifically referenced in the patent application. (*See*, for example, page 28, lines 20-24 of the specification, referencing the "Handbook of Thin-Film Deposition Processes and Techniques" (Noyes, 1988) (detailing, in four-hundred-thirteen pages, numerous deposition technologies, and outlining which techniques are suited for deposition of particular materials or components thereof)[3]; *see also,* page 38, line 6 of the specification, referencing EP 260965 of Wong *et al.*; *see also,* page 31, line 5 of the specification (referencing Sze, VSLI Technology, and also referencing Mead *et al.*, Introduction to VSLI Systems)). Processing of delivered components, required in some of the claims, is also particularly described, both with respect to inorganic materials, and with respect to non-biological polymeric materials. (*See*, for example, page 49, line 18 through page 53, line 11 of the specification). The specification further teaches that the arrays of inorganic materials can be screened according to many specifically-known techniques for specifically-known properties of interest. (*See*, for example, page 53, line 12 through page 58, line 4 of the specification). Moreover, numerous examples provided in the specification expressly demonstrate the inventions defined by the presently-pending claims – both for inorganic materials and for non-biological polymeric materials.

Extensive literature existing in the art at the time the application was filed demonstrates the level of knowledge known in the art regarding further particular aspects of each of the techniques described in the specification – with respect to both synthesis and screening of inorganic materials. *See*, for example, Handbook of Deposition Technologies for Films and Coatings, 2nd Ed. (Noyes, 1994) (discussing, in eight-hundred-sixty-one pages, deposition techniques and selection thereof for various industrial applications)[4]; *see also* Fister, L. *et al.*

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3 A copy of the table of contents of this reference are enclosed as Appendix B hereof.

4 A copy of the table of contents of this reference are enclosed as Appendix C hereof.

Controlling Solid State Reactions via Rational Design of Superlattice Reactants, *Adv. Synth. React. Solids* 2, 155 (1994).[5]

Contrary to the position set forth in the Office action, the specification would have enabled a skilled artisan to fully practice the inventions as presently claimed. The Office action asserts, *inter alia*, that the specification fails to provide adequate guidance to correlate the selection of specific delivery techniques and/or specific components to a particularly-desired property of interest. (*See* subparagraphs 1a, 1b and 1c of paragraph 6, at pages 4-5 of the Office action, and subparagraph 4b of paragraph 6, at page 6 of the Office action.). However, such assertion appears to misconstrue the nature and purpose of present invention. The invention is not directed to particular *materials* having particular properties. The invention is also not directed to *a priori* prediction of a correlation between delivery techniques and/or components to particular properties. Rather, the present invention is directed to *methods for making arrays where the arrays are useful for identifying materials* having a particular property of interest, and to *methods for identifying useful materials* by using such arrays. As such, a skilled artisan would be able to practice the present invention by selecting materials and/or components thereof in a completely random fashion, without consideration of known underlying scientific principles and/or without consideration of specific relationships between particular materials or components and a particular property of interest. Alternatively, and more logically, a skilled artisan would be able to practice the invention by selecting materials and/or components starting, for example, from known scientific principles or from specifically known material-property relationships.

Additionally, with regard to the latter approach, the Office action appears to discount the vast warehouse of knowledge existing in the art upon which a skilled artisan could base appropriate initial selections for components and delivery techniques for making arrays of

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[5] A copy of this reference is provided with the Information Disclosure Statement submitted herewith. Niether the submission of this reference or Applicants' remarks in connection therewith should be considered to be an admission with respect to whether the Fister *et al.* reference is statutory prior art to the instant invention. Applicants expressly reserve the right, if necessary, to submit evidence that Applicants invented the subject matter defined by the claims before the publication date of the Fister *et al.* reference.

materials. With respect to the state of the prior art, the Office action appears to consider only the then-existing art related to making arrays of materials, with specific reference to "biologically relevant organic materials". (*See* subparagraph 4a of paragraph 6 at page 6 of the Office action). The Office action does not appear to consider the teaching of numerous references directed to the forming of individual inorganic materials, or directed to material-property relationships of known materials. The teaching of such references, considered in combination with the instant specification, could have been readily applied by a skilled artisan to make arrays of inorganic materials or non-biological polymeric materials as required in the presently-pending claims. Likewise, the Office action does not appear to consider the teaching of numerous references directed to screening methodologies that could have been applied, in view of the teaching of the specification, to evaluate the arrays of inorganic materials. The law is clear that a patent specification need not teach, and preferably omits what is generally known in the art. *See* Hybritech v. Monoclonal Antibodies, 231 USPQ 81, 94 (Fed. Cir. 1986). As such, Applicants are entitled to rely on such knowledge in the art in combination with the further teaching of the instant specification.

Moreover, even if some experimentation were required to adapt such methods for use in connection with the present invention, the Office action does not establish, *prima facie*, that the level of experimentation required would have been undue to practice the invention as claimed. *See* In re Wands, 8 USPQ2d 1400 (Fed. Cir. 1988).

The present Office action argues that "the instant claims would cover literally any process of making any material which has more than one component".[6] Although acknowledging that a vast warehouse of knowledge exists concerning embodiments encompassed by the claims, the Office action states that, even when considered in view of the substantial guidance provided in Applicants' specification, the teaching is not commensurate with the scope of the claims. (*See* paragraphs 7 and 9 on pages 6-7 of the Office action).

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6 Applicants note that the required methodologies do not, in fact, cover "*any process of making any material*" as asserted in the Office action; rather, the Applicants' inventions require particularly-recited process steps for making arrays of materials. Although most of the claims defining the invention are not limited to particular component-delivery protocols, the scope of the claims with respect to delivery of material components is fully enabled in view of the specification and knowledge in the art, as discussed in response to the instant rejection.

Applicants strongly disagree with this position. A person of ordinary skill in the art would have been able to make arrays according to the required protocols by using one or more of the numerous delivery techniques recited in the specification. The Office action does not identify any element, compound or composition that could not be delivered to a substrate using, as taught by Applicants, one or more of the following delivery techniques: thin-film deposition methods, including multi-target thin film deposition methods such as evaporative methods, glow-discharge processes (*e.g.*, sputtering), gas-phase chemical processes (*e.g.*, chemical vapor deposition methods), or liquid-phase chemical processes (*e.g.*, mechanical approaches such as spraying, spinning, dipping, coating, brushing, *etc.*), in combination with physical masking or photolitographic masking, and/or as implemented using various dispensers such as ink-jet dispensers. As noted, each of these delivery techniques are disclosed in significant detail, and are particularly suited to delivery of inorganic components. Moreover, the prior art literature demonstrates that most, if not all, of the elements, and many compounds and compositions have been individually applied to or formed on a substrate using such methods. As such, a person of ordinary skill in the art would have been enabled to make arrays in the manner defined by Applicants inventions.

The Office action also states that the art of materials science, and particularly, the "anticipation of the properties of any inorganic material" is inherently unpredictable because "it is not possible to predict *a priori* which materials will have which properties, or how the methods of applying the materials will effect the properties". (*See* paragraph 8 at page 7 of the Office action).

Applicants respectfully point out that the use of Applicants invention does not require *a priori* correlation between particular materials and particular properties, as suggested in the Office action. In fact, it is the unpredictable nature of materials science research that makes Applicants' invention so useful. As noted above, a person of skill in the art would be enabled to use Applicants invention by selecting a particular end-use application (typically defined by commercial or academic research interests), defining the properties of interest that are important to such an application, and then selecting materials to test for those properties of interest – with such selection being entirely random, or more likely and more preferably, with

such selection based on art-based knowledge about particular classes of materials. Significantly, even "negative results" with respect to whether a particular material has a particular property of interest is useful to a materials scientist. As such, a person of ordinary skill in the art would have been enabled to use arrays in the manner defined by Applicants inventions.

Accordingly, because a skilled artisan would have been enabled to make and to evaluate arrays comprising materials as presently claimed, Applicants' inventions are enabled.

Rejections Under 35 U.S.C. §102(e) – Cavicchi *et al.*

The Office action rejects independent claims 42, 68, 70 and 74, together with certain claims dependent therefrom (claims 8, 10, 11, 15-19, 23, 24, 26, 29-36 [sic: 30-35],[7] 43, 45-49, 51-54, 60, 64-66, 69, 71, 77, 78 and 80)[8] as being anticipated under 35 U.S.C. §102(e) by U.S. Patent No. 5,365,756 to Cavicchi *et al.* (*See*, generally, paragraph 14 at page 9 of the Office action).[9]

Applicants respectfully traverse this basis for rejection in view of the amendments to the claims and the following remarks.

As amended, each of the independent claims requires forming ten or more different inorganic materials on a substrate by a method that includes (i) delivering a first component of

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[7] Applicants note that claims 29 and 36 were cancelled in Amendment B.

[8] As such, Applicants note that there are no prior art rejections for claims 20-22, 55, 56, 67, 72, 75 or 76.

[9] The Office action sets forth numerous conclusive statements regarding what Cavicchi *et al.* teaches with respect to various claimed aspects of the invention, and /or regarding what Applicants claims mean. Applicants expressly disagree with many of the statements asserted in the Office action in this regard. Some particular points of disagreement are discussed herein, to the extent necessary to distinguish the invention defined by the presently pending claims. Applicants have not, however, specifically addressed other particular points of disagreement, since such points are moot in view of the arguments set forth by Applicants. Applicants are not conceding the factual accuracy of any statements set forth in the Office action, except to the extent expressly admitted by Applicants. Applicants do not admit or acquiesce to statements in the Office action upon which Applicants have not commented.

the material to the substrate to form a first *solid* layer comprising the first component on the substrate, (ii) delivering a second component of the material to the substrate to form a second *solid* layer comprising the second component on the first layer, and (ii) varying the composition, concentration, stoichiometry or thickness of the *delivered* (first or second) *component* between respective regions. As demonstrated below, Cavicchi *et al.* do not disclose such methods for making arrays of diverse materials. Additionally, Cavicchi *et al.* do not disclose or teach other required aspects of certain independent and/or dependent claims, as discussed below.

Cavicchi *et al.* discloses fabrication of a plurality of micro-hotplates on a common substrate, each of which can be controlled independently from each other with respect to temperature and/or voltage bias. The reference discloses that the array of micro-hotplates can be used for process optimization by exploring the effects of locally-varying processes conditions – particularly in connection with deposition studies and materials development (*e.g.*, film microstructure analysis, processing of high-temperature superconductors, thermal-fatigue testing, melt transition temperatures, gas-surface interaction studies, *etc.*). The reference also discloses end-use applications such as chemical sensors.

Contrary to the position set forth in the Office action, Cavicchi *et al.* do not disclose making an array of different materials to be tested for a property of interest by delivering two or more components to form *solid* layers where at least one of the components are varied – *as delivered* – with respect to composition, concentration, stoichiometry or thickness.

In the Office action, Cavicchi *et al.* are said to disclose, with reference to Figure 6 thereof, applying at least two materials (*e.g.*., Sn and oxygen) to form tin oxide films – specifically, by first sputtering Sn and then annealing in O_2. (*See* paragraph 14 at page 9 (last line) through page 10 (first line) of the Office action; *see also* paragraph 16 of the Office action). Such disclosure is said to anticipate Applicants' invention in that Sn is a first layer and is O_2 is a second layer.[10] *Id.* Applicants note, however, that the referenced sputtering process

[10] The Office action also states that the noted disclosure "reads on the instant invention as defined in the instant specification, page 28, lines 6-24.". Applicants respectively submit that such observation is moot, since the claims – not the specification – define the invention.

involved *reactive* RF sputtering in which a Sn target was sputtered in the presence of an oxygen and argon gas mixture. As such, Cavicchi *et al.* deposited a single film of SnO_2 – not separate films of Sn followed by O_2. Furthermore, the instant amendment clarifies that components are delivered to form successive solid layers. Moreover, Cavicchi *et al.* do not disclose any variation in the composition, concentration, stoichiometry, or thickness of either the Sn [sic: SnO_2] or O_2 components as delivered to the substrate.[11] Rather, differences in materials, if any, were formed by varying the process under which the Sn component was delivered – not by varying the composition, concentration, stoichiometry or thickness of the delivered component. Accordingly, in view of these three distinctions, the Cavicchi *et al.* disclosure does not anticipate the present invention. As discussed below, the difference between Applicants' approach and that disclosed in Cavicchi *et al.* has substantial implications with respect to materials science research.

Cavicchi *et al.* are also said to teach an array of materials comprising two or more layers, with reference in this regard to the growth of an epitaxial GaAs layer on a Si substrate. Specific reference is made to Col. 13, lines 5-26 of the Cavicchi *et al.* patent. (*See* paragraph 14 at page 10, lines 1-4 of the Office action). As noted in Amendment B, however, a skilled artisan would have understood that when read in context, the GaAs material is formed as a single layer – and is not a test material comprising two or more layers of delivered components. More specifically, the referenced portion of Cavicchi *et al.* would have been understood as describing applications in which electronic devices are fabricated using high-

[11] The Office action erroneously states, in one portion thereof, that Cavicchi *et al.* teach that oxygen is "delivered in a different amount based upon the temperatures of the substrates during SnO_2 preparation." (*See* paragraph 14, sentence wrapping from page 10 to page 11 – referring to Figure 6 and accompanying text of Cavicchi *et al.*). Such variation in oxygen delivery is not taught by Cavicchi *et al.* in connection with Figure 6, as contended by the Office action. The referenced portion of Cavicchi *et al.* discusses variations in temperature during deposition of SnO_2, but does not disclose any variation in the amounts of oxygen delivered. The erroneous nature of the above-identified position set forth in the Office action is demonstrated, moreover, by the fact that the Office action subsequently relies on exactly the opposite contention in connection with its discussion of claim 77. (*See* paragraph 16 of the Office action – stating, with reference to the same portion of Cavicchi *et al.,* that "annealing is performed simultaneously under a common set of conditions.").

temperature processing or high-temperature device operation for some components on the chip, while thermally isolating other components on the chip. (*See* Col. 13, lines 5-9 of Cavicchi *et al.*). As one example, Cavicchi *et al.* discloses chemical sensors, such as can be based on semiconductor oxides materials formed as a film over the contact pad (numbered as "10" in Figure 4) of the micro-hotplate, where ohmic contact to the semiconductor oxide is provided by interdiffusion between the contact pad and the semiconductor oxide. (*See* Col. 13, lines 9-19 of Cavicchi *et al.*). As an alternative approach, Cavicchi *et al.* discloses providing a thermally-isolated *substrate* that includes exposed crystalline Si upon which GaAs can be epitaxially grown, without thermal damage to other devices on the wafer. Hence, a skilled artisan would have understood both of these disclosed embodiments as teaching the formation of material comprising a <u>single layer</u> to be tested in the micro-hotplate device of Cavicchi *et al.*. The underlying substrate – that is, the underlying micro-hotplate, or portions thereof (*e.g.*, the "contact pads" or the "exposed crystalline Si"), would <u>not</u> have been considered as part of the material being tested. As such, this teaching of Cavicchi *et al.* does not anticipate the inventions defined by the presently-pending independent claims, each of which require that the material being made for testing comprise, in its final or intermediate form, <u>two or more layers of delivered components</u>. Moreover, Cavicchi *et al.* do not disclose, with respect to this embodiment, any variation in the composition, concentration, stoichiometry, or thickness of delivered components of such a GaAs film.

The Office action further posits that Cavicchi *et al.* teaches "that layers of materials can be applied on those which have previously been applied", such that claims 30-36 [sic: 30-35] and 65 are anticipated. (*See* paragraph 14, third full paragraph of page 11). However, the Office action does not provide reference to the portion of Cavicchi *et al.* upon which it is relying for such assertion. Applicants acknowledge, in this regard, that Cavicchi *et al.* disclose that after deposition of materials onto the micro-hotplate, the resulting materials can be subjected to various post-processing treatments that include the "subsequent deposition of additional materials". (*See* Col. 10, lines 41-46). However, the Cavicchi *et al.* reference does not teach or suggest whether such "additional materials" are to be deposited to the same micro-

hotplate (*i.e.,* over the previously-deposited material) or to other micro-hotplates within the array. The reference appears to teach the latter, as the following paragraphs describe various approaches for selectively depositing to various selected micro-hotplates within the array. (*See*, for example, Col. 10, lines 47-64 (selective conventional lithography), and Col. 10, line 65 through Col. 11, line 16 (selective "maskless" lithography)). Moreover, the Cavicchi *et al.* reference does not teach whether such "additional materials" are the same as or different from the earlier-deposited materials. Further, in any case, the reference does not disclose controlling the relative composition of the *delivered components* to vary between the ten or more respective regions.

Finally, the Office action states that Cavicchi *et al.* disclose variable compositions – because "multiple samples fabricated under a variety of conditions are taught." (*See* paragraph 18 of the Office action; *see also* paragraph 14, at the last paragraph of page 11). However, the teaching of Cavicchi *et al.* relating to different process conditions does <u>not</u> *necessarily* lead to the conclusion that multiple samples would be formed with varying compositions. Although it is possible that variation of process conditions could, in some instances, have some marginal affect on composition, such process variations could also have no affect on material composition, or may affect factors other than composition (*e.g.*, grain size). As such, to the extent the Office action relies on inherency to establish that Cavicchi *et al.* teach variations in composition, such reliance is misplaced. The law is clear that inherency may not be established by possibilities or probabilities; rather, the required feature must <u>necessarily</u> follow from the teaching of the reference. *See* MPEP 2112; *Continental Can Company USA vs. Monsanto Company*, 20 USPQ2d 1746 (Fed. Cir. 1991). Additionally, even if Cavicchi *et al.* were considered, *arguendo*, to teach the formation of arrays comprising different materials (including arrays of materials having different compositions) by applying variations in <u>process</u> conditions, such disclosure would <u>not</u> anticipate Applicants' invention. The inventions defined by the presently-pending claims require that one or more of the <u>delivered components</u> are varied with respect to composition, concentration, stoichiometry or thickness as compared between regions. Proactively varying the composition, concentration, stoichiometry or thickness as required by the present invention – rather than varying only process parameters as

taught by Cavicchi *et al.* – results in substantial benefits for materials discovery research. Briefly, for materials discovery research, both chemical diversity (*e.g.*, composition) and physical diversity (*e.g.* grain size) can be of substantial importance with respect to effecting commercially-important changes in material properties. Significantly, a substantially larger scope of chemical diversity can be achieved by varying parameters (*e.g.* composition, *etc.*) of delivered components as taught by Applicants – as compared to that which could be achieved by varying process parameters as disclosed by Cavicchi *et al.*).

Hence, the Cavicchi *et al.* reference would not have been understood by a skilled artisan as disclosing the inventions defined by the presently-pending claims, which require delivery of a first component to form a first layer in each of the ten or more predefined regions of the substrate, with subsequent delivery of a second component to form a second layer over the first layer in each of the ten or more regions, while varying the composition, concentration, stoiciometry and/or thickness of the delivered components between respective regions for the first and/or the second components. As such, Cavicchi *et al.* does not anticipate the presently-pending claims.[12]

In addition to the aforementioned, Cavicchi *et al.* do not disclose or teach other required aspects of certain independent and/or dependent claims. In particular, Applicants note that Cavicchi *et al.* do not anticipate claim 70, because they do not disclose arrays of diverse materials formed by sequentially delivering *five or more* components to form five or more solid layers thereof, while varying the composition, concentration, stoichiometry or thickness of at least one of the delivered components. Likewise, Cavicchi *et al.* do not anticipate claim 74 because they do not disclose forming an array comprising ten or more different *composite materials* according the protocol set forth therein. Further, claim 80 is not anticipated because Cavicchi *et al.* do not disclose forming an array of materials that *consists essentially of the substrate and ten or more different materials* – thereby excluding substrates comprising active devices such as micro-hotplates as taught by Cavicchi *et al.* Finally, Applicants note that new

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[12] The invention defined by the presently pending claims is likewise not obvious over Cavichhi *et al.*, as discussed previously in remarks set forth in Amendment B (p. 23-27).

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claims 84 and 88 require steps and features not disclosed in Cavicchi *et al.* Specifically, claim 84 requires that the composition, concentration, stoichiometry or thickness of the delivered first or second components are varied *as a gradient* as compared between different regions. Claim 88 requires sequential repetition of the delivering and varying steps to form a *lattice or superlattice* comprising the first and second components.

Provisional Obviousness-Type Double Patenting Rejections

Each of the previously-pending, non-withdrawn claims have been rejected under the judicially created doctrine of obviousness-type double patenting as allegedly being unpatentable over various claims of, independently, U.S. Patent No. 5,985,356 to Schultz *et al.*, and U.S. Patent No. 6,004,617 to Schultz *et al.* (*See* paragraphs 21 and 22 at pages 14-15 of the Office action).

Applicants will consider submitting a terminal disclaimer with respect to obviate each of these rejections, if necessary, once substantive agreement on the merits is reached.

Each of the previously-pending, non-withdrawn claims have also been provisionally rejected under the judicially created doctrine of obviousness-type double patenting as allegedly being unpatentable over various claims of, independently, copending U.S. patent applications Ser. No. 09/127,195 and Ser. No. 09/156,827.

Applicants traverse these provisional double patenting rejections for the reasons set forth below.

The claims of U.S. Patent Application Ser. No. 09/127,195 are directed to methods of making arrays of non-biological polymers. All of the presently-pending independent claims, with the exception of claim 74, are directed to or require methods of making array of inorganic materials. Applicants submit that these methods are patentably distinct, and as such, the instant obvious-type double-patenting rejection is inappropriate. In fact, the U.S. Patent Office has consistently taken the position that making arrays of inorganic materials is a patentably distinct species from making arrays of non-biological polymers. In the instant case, the restriction requirement mailed November 23, 1999 clearly articulates such a position. Moreover, in the parent application of the instant case, U.S. Ser. No. 08/327,513 (from which

the '356 patent issued), the Patent Office issued a restriction requirement that likewise articulated the position that the methods of making arrays of inorganic materials are patentably distinct from the methods of making arrays of non-biological polymers. As such, with the exception of presently claim 74, this obvious-type double-patenting rejection is improper.

The claims of U.S. Patent Application Ser. No. 09/156,827 are directed to methods of forming arrays of materials using solution-based and sol gel-based protocols. However, each of the presently-pending independent claims require successive deposition of components as solid layers. The Office action does not set forth a *prima facie* case of obviousness as to why a person of ordinary skill in the art would have been led to form successive layers of solid components in view of the claims of the'827 application. Although, as recognized in the Office action, solution-based methodologies can be used form the successive solid layers of components in the instant invention, this does not establish that such methods would have been obvious in view of the claims of the '827 application. Accordingly, this obvious-type double-patenting rejection is improper.

Equivalents

The amendments to the claims and the arguments presented in response to the Office action have been made to claim subject matter which the Applicants regard as their invention. By such amendments, the Applicants in no way intend to surrender any range of equivalents beyond that which is needed to patentably distinguish the claimed invention as a whole over the prior art. Applicants expressly reserve patent coverage to all such equivalents that may fall in the range between applicants literal claim recitations and those combinations that would have been obvious in view of the prior art. In particular, no claims have been narrowed within the meaning of *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 56 USPQ2d 1865 (Fed. Cir. 2000), and Applicants are therefore entitled to the full range of equivalents with respect to each of the presently-pending claims.

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CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

The Examiner is hereby authorized to charge the fees for the new claims (~~$448~~ $260 pas), as well as any other fees required in connection with this application to Deposit Account No. 50-0496.

Respectfully submitted,

Date Submitted: 5-17-01

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APPENDIX A

MARKED UP VERSION INDICATING AMENDMENTS TO THE SPECIFICATION AND CLAIMS, AND INDICATING NEW OR CANCELLED CLAIMS

IN THE CLAIMS

***Changes to the previously-pending claims are as follows:

42. (thrice amended) A method for making an array of diverse materials, the method comprising

forming ten or more inorganic materials on ten or more predefined discrete regions of a rigid substrate, respectively, each of at least ten of the materials being different from each other and being formed by a method that comprises

delivering a first component of the material to the respective predefined discrete region of the substrate to form a first solid layer of the first component on the substrate,

delivering a second component of the material to the respective predefined discrete region to form a second solid layer of the second component on the first layer, and

varying the composition, concentration, stoichiometry or thickness of the delivered first or second components between respective regions,

the substrate comprising a sufficient amount of space between the ten or more regions such that the delivered components do not substantially interdiffuse between the ten or more regions of the substrate.

68. (thrice amended) A method for making an array of diverse materials, the method comprising

forming ten or more inorganic materials on ten or more predefined discrete regions of a rigid substrate, respectively, each of at least ten of the materials being different from each other and being formed by a method that comprises

delivering a first component of the material to the respective predefined discrete region of the substrate to form a first solid layer of the first component on the substrate,

delivering a second component of the material to the respective predefined discrete region to form a second <u>solid</u> layer of the second component on the first layer, and

varying the composition, concentration, stoichiometry or thickness of the delivered <u>first or second</u> components between respective regions.

70. (thrice amended) A method for making an array of diverse materials, the method comprising

forming ten or more inorganic materials on ten or more predefined discrete regions of a substrate, respectively, each of at least ten of the materials being different from each other, and being formed by a method that comprises

sequentially delivering five or more components of the material to the respective predefined discrete region of the substrate to form five or more <u>solid</u> layers of the delivered components, each of at least five of the delivered components being an inorganic element or compound, and

varying the composition, concentration, stoichiometry or thickness of <u>at least one of</u> the <u>five or more</u> delivered components between respective regions.

72. (thrice amended) A method for identifying useful materials, the method comprising

forming one hundred or more solid inorganic materials on one hundred or more predefined discrete regions of a rigid substrate, respectively, each of at least one hundred of the materials being different from each other and being formed by a method that comprises

delivering a first component of the material to the respective predefined discrete region of the substrate to form a first <u>solid</u> layer of the first component on the substrate,

delivering a second component of the material to the respective predefined discrete region to form a second <u>solid</u> layer of the second component on the first layer,

varying the composition, concentration, stoichiometry or thickness of the delivered <u>first or second</u> components between respective regions, and

allowing the delivered first and second components of the material to simultaneously interact under a set of conditions,

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the substrate comprising the at least one hundred material-containing regions at a density of greater than about 10 regions per cm^2, the substrate further comprising a sufficient amount of space between the at least one hundred material-containing regions such that the delivered components do not substantially interdiffuse between the at least one hundred material-containing regions of the substrate,

screening the at least ten different materials for one or more useful properties of interest, and

determining the relative performance of the at least ten different materials with respect to the property of interest.

74. (twice amended) A method for identifying useful materials, the method comprising

forming ten or more inorganic or non-biological polymeric materials on ten or more predefined discrete regions of a substrate, respectively, each of at least ten of the materials being composite materials that are different from each other and being formed by a method that comprises

delivering a first component of the composite material to the respective predefined discrete region of the substrate to form a first <u>solid</u> layer of the first component on the substrate,

delivering a second component of the composite material to the respective predefined discrete region to form a second <u>solid</u> layer of the second component on the first layer, and

varying the composition, concentration, stoichiometry or thickness of the delivered <u>first or second</u> components between respective regions,

screening the at least ten different composite materials for one or more useful properties of interest, and

determining the relative performance of the at least ten different composite materials with respect to the property of interest.

*** Claims 81-95 are new.